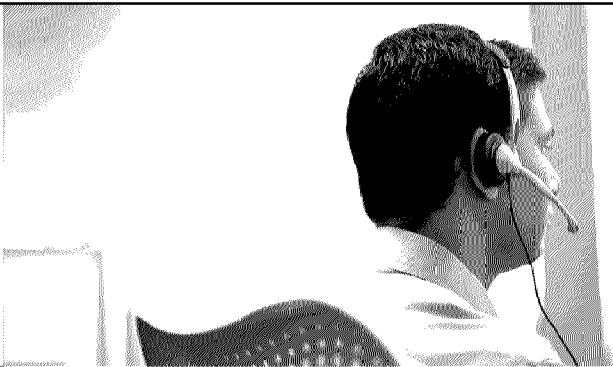



# EXHIBIT G



**Robert Wright**

**EDCS-765200**

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## Agenda

- Team members
- Problem that we needed to solve
- Cost of solving the problem 100% manually
- Solution
- Components of the solution
- Results from SDCC phase 1
- Other CICV Features
- What's next?

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## Agenda

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# SDCD

## ▪ Team Members



Robert Wright  
PM  
SDCD concept development



Bob Monsen  
PCA Development



Mark Novembrino  
SDCD code development



Atul Patil  
PCA Development



Prathima Venkatesan  
PCA Development



Sastry Varanasi  
PCA Development

## Agenda

- Team members
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## Problem that we Needed to Solve

- Documentation is missing syntax

<b>show arap</b>	
To display information about a running AppleTalk Remote Access Protocol (ARAP) connection, use the <b>show arap</b> command in EXEC mode.	
<b>show arap [line-number]</b>	
<b>Syntax Description</b>	
<i>line-number</i>	(Optional) Number of the line on which an ARAP connection is established and active.

Extract from the show arap command documentation in the *Cisco IOS Terminal Services Command Reference, Release 12.4T*

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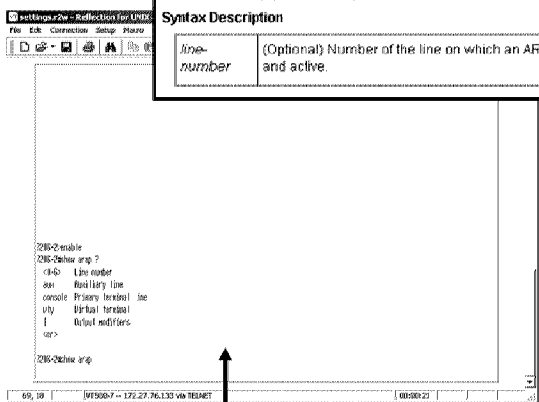
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## Problem that we Needed to Solve

- Documentation is missing syntax



```

R7200-2>show arap ?
show arap Line number
show arap Auxiliary line
show arap Primary line
show arap Virtual terminal
show arap Output modifiers
show arap

```

**show arap**  
 To display information about a running AppleTalk Remote Access Protocol (ARAP) connection, use the **show arap** command in EXEC mode.  
**show arap [line-number]**

**Syntax Description**  

line-number	(Optional) Number of the line on which an ARAP connection is established and active.
line-number	

CLI session with a Cisco 7200 series router in the KMD Documentation Lab – entering the show arap ? command

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## Problem that we Needed to Solve

- Documentation is missing syntax

**show arap**  
To display information about a running AppleTalk Remote Access Protocol (ARAP) connection, use the **show arap** command in EXEC mode.

**show arap [line-number]**

**Syntax Description**

line-number	(Optional) Number of the line on which an ARAP connection is established and active.
<0-6>	Line number
aux	Auxiliary line
console	Primary terminal line
vty	Virtual terminal
	Output modifiers
<cr>	

7206-2# show arap ?  
<0-6> Line number  
aux Auxiliary line  
console Primary terminal line  
vty Virtual terminal  
| Output modifiers  
<cr>

CLI session with a Cisco 7200 series router running Cisco IOS 12.4(22)T in the KMD Documentation Lab – entering the show arap ? command

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## Problem that we Needed to Solve

- Documentation is missing syntax

**show arap**  
To display information about a running AppleTalk Remote Access Protocol (ARAP) connection, use the **show arap** command in EXEC mode.

**show arap [line-number]**

Syntax Description	
<i>line-number</i>	(Optional) Number of the line on which an ARAP connection is established and active.

```

7206-2# show arap ?
<0-6>      Line number
aux        Auxiliary line
console    Primary terminal line
vty        Virtual terminal
!          Output modifiers
<cr>
  
```

7206-2# show arap ?	
<0-6>	Line number
aux	Auxiliary line
console	Primary terminal line
vty	Virtual terminal
!	Output modifiers
<cr>	

The documentation indicates that the show arap command has only one argument – the Cisco IOS 12.4(24)T image on the router shows that there are additional keywords for this command

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## Problem that we Needed to Solve

- Historical causes of documentation missing syntax

Documentation groups are not notified when code changes are made

Limited access to networking devices to verify the CLI syntax while writing the documentation

Lack of training in performing CLI syntax verification on networking devices

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## Problem that we Needed to Solve

- Mitigation of the historical causes of documentation missing syntax

Documentation groups are not notified when code changes are made – Behavior Change Notification Program (EDCS-730050)

Limited access to networking devices to verify the CLI while writing the documentation – Comprehensive KMD Lab Facilities Now Available (EDCS-593075)

Lack of training in performing CLI syntax verification on networking devices – CLI Verification Training Now Available (EDCS-628298)

A thorough discussion of the mitigations listed here is beyond the scope of this presentation – please refer to the documents in EDCS listed above

Contact [rwright@cisco.com](mailto:rwright@cisco.com) if you cannot access these documents

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## **Problem that we Needed to Solve**

- Still need to find CLI syntax errors in the documentation that existed prior to the mitigations noted on the previous slide
- Still need to find CLI syntax errors in the documentation that are not prevented by the mitigations noted on the previous slide

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## Agenda

- Team members
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## **Cost of Solving the Problem 100% Manually**

- At the time the SDCD project was started there were approximately 14K\* Cisco IOS commands documented in the documentation database
- A pilot of performing 100% manual verification of the Cisco IOS commands in the documentation database estimated the cost of manual CLI syntax verification to be approximately one million dollars

\*There are now over 16K commands documented in the documentation database,

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## Agenda

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## Solution

- Create a tool that can systematically identify syntax errors in the on-line documentation (Command References) for Cisco IOS commands

Saves the time that would have been spent doing manual verification on commands that are found not to have errors

Still have to manually verify commands that are found to have errors because the tool only finds some of the possible problems with the commands

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## Solution

**Cisco IOS Command Validation Tool**

Command Doc Quality Analysis - MCLs | **Command Doc Quality Analysis - CRs** | Compare Releases | Syntax Walker | MCL Reverse Analysis

Master Command List URLs

Read PCA Files

Report Log

Submit Clear

Download Excel Report

Version 0008

The Command Doc Quality Analysis – CRs feature does a comparison of the commands in a PCA report with the documented syntax for commands in the Cisco IOS command references

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# Solution

Cisco IOS Command Validation Tool

Command Doc Quality Analysis - MCLs

Command Doc Quality Analysis - Cfgs

Configure Releases

Syntax Walker

MCL Reverse Analysis

Read PCA Files

Master Command List URLs

http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t\_08.html

http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t\_09.html

Report Log

Submit

Clear

Download Excel Report

Version 0006

URLs for the on-line Master Command Lists (MCLs)

# Solution

Cisco IOS Command Validation Tool

Command Doc Quality Analysis - MCLs | Command Doc Quality Analysis - CFGs | Compare Releases | Syntax Walker | MCL Reverse Analysis

Master Command List URLs

Read PCA Files

Upload the PCA data files

Report Log

Submit

Clear

Download Excel Report

http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t\_08.html

http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t\_09.html

Version 0006

# Solution

Cisco IOS Command Validation Tool

Command Doc Quality Analysis - MCLs | Command Doc Quality Analysis - CFGs | Complete Releases | Syntax Walker | MCL Reverse Analysis

Read PCA Files

Master Command List URLs  
[http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t\\_08.html](http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t_08.html)  
[http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t\\_09.html](http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t_09.html)

Report Log

Submit

Submit Clear

Download Excel Report

Version 0006

# Solution

Cisco IOS Command Validation Tool

Command Doc Quality Analysis - MCLs | Command Doc Quality Analysis - CFGs | Compare Releases | Syntax Walker | MCL Reverse Analysis

Read PCA Files

Master Command List URLs  
[http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t\\_08.html](http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t_08.html)  
[http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t\\_09.html](http://www.cisco.com/en/US/docs/ios/mcl/124/mcl/124t_09.html)

Report Log

Command instances:  
show zone security  
show zone security-std-string  
-----  
Total missing commands: 762  
Done  
0 hour(s) 7 minute(s) 24 second(s)

Submit | Clear

Download the report

Download Excel Report

Version 0006

# Solution

- CICV error report

A		B	
1	CICV Error Status	Command	Syntax Analysis
53	Command has errors	show arap	show arap lty <number>
54			show arap aux <number>
55			show arap console <number>
56			show arap vly <number>
57			
58	Command is not documented	show archive config rollback commands	show archive config rollback commands <text-s
59			show archive config rollback commands <text-s
60			

show arap command is found to have errors

## Agenda

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## Components of the solution

- Cisco Command Validation Tool (CICV)
- Parse chain analyzer (PCA)
- Cisco IOS Master Command Lists (MCL)
- Cisco IOS Command References (CR)

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## Components of the solution

- CICV Tool

The screenshot shows the web interface of the Cisco IOS Command Validation Tool. At the top, there is a title bar "Cisco IOS Command Validation Tool". Below it is a navigation menu with links: "Command Doc Quality Analysis - MCLs", "Command Doc Quality Analysis - CRs", "Compare Releases", "Syntax Walker", and "MCL Reverse Analysis". The main content area has a "Master Command List URLs" section with a "Read PCA Files" button and a text input field. Below this is a "ReportLog" section with a large text area and a "Download Excel Report" link. At the bottom of the main area are "Submit" and "Clear" buttons. The footer of the tool interface says "Version 0006".

The CICV tool is coded in JAVA and runs on a UNIX server

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## Components of the solution

- PCA

A tool owned by the Infrastructure TC-Embedded Management Engineering group

Analyzes Cisco IOS source code and other data sources

Outputs CLI syntax and other data

PCA Site

[http://wiki-eng.cisco.com/engwiki/PCA\\_20\\_28Parse\\_20Chain\\_20Analyzer\\_29](http://wiki-eng.cisco.com/engwiki/PCA_20_28Parse_20Chain_20Analyzer_29)

The CICV tool uses only the PCA CLI syntax reports

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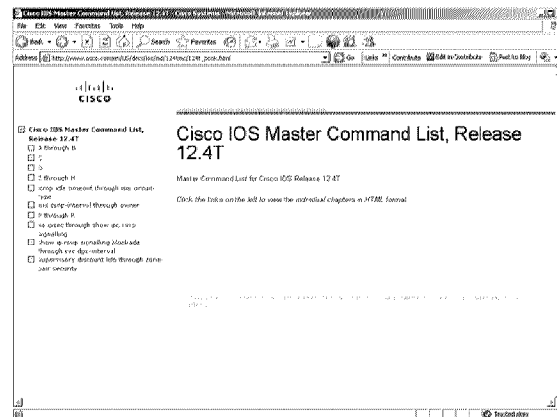
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## Components of the solution

- Cisco IOS MCLs

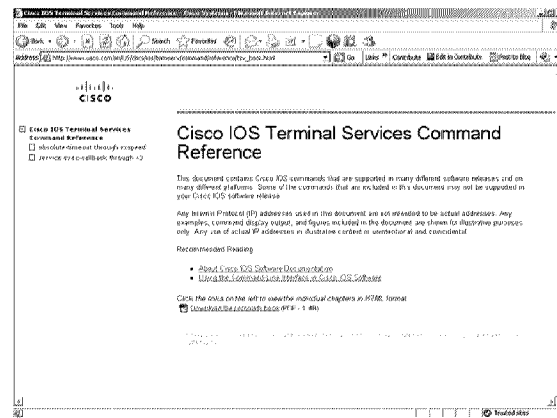
Complete on-line lists of the documentation for the commands in a Cisco IOS release – for example, 12.4T



## Components of the solution

- Cisco IOS CRs

Syntax, usage guidelines and examples for Cisco IOS commands for a specific technology area – for example, Terminal Services



## Components of the solution

- Cisco IOS MCLs & CRs

The commands listed in the MCL are hyperlinked to the documentation for the command in the CR

**Extract from the MCL**

```
show appletalk zone ATK-178
show ops B-694
show arap ISV-128
show archive CF-556_HA-411
show archive config differences CF-558
show archive config incremental-diffs CF-580
show archive log config CF-562
```

**show arap**

To display information about a running AppleTalk Remote Access Protocol (ARAP) connection, use the **show arap** command in EXEC mode.

**show arap [line-number]**

**Syntax Description**

Field	Description
Line-Number	(Optional) Number of the line on which an ARAP connection is established and active.

**Command Modes**

EXEC

**Command History**

Release	Modification
10.0	This command was introduced.
12.2(50)	This command is supported in the Cisco IOS Release 12.2(50) train. Support for a specific 12.2(50) release of this train depends on your feature set, platform, and platform hardware.

**Usage Guidelines**

Use the **show arap** command with no arguments to display a summary of the ARAP traffic since the router was last booted.

**Examples**

The following is sample output from the **show arap** command:

```
Router# show arap

Description: show arap output since last reboot
Total ARAP connections: 0
Total AppleTalk packets received: 127824
```

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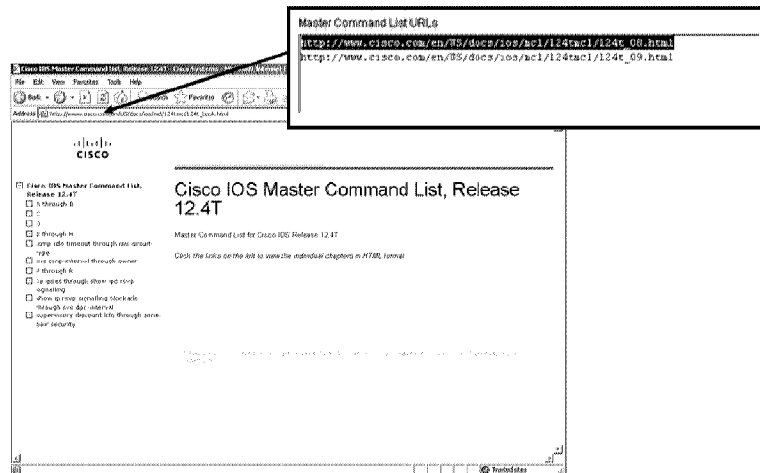
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## Components of the solution

### ■ Cisco IOS MCLs

MCL data entry section of the CICV tool



The CICV tool reads in the MCL HTML code from the URL and starts analyzing it to find the links to the documentation for each command – this all happens behind the scenes, the web page is shown here to help you visualize the process

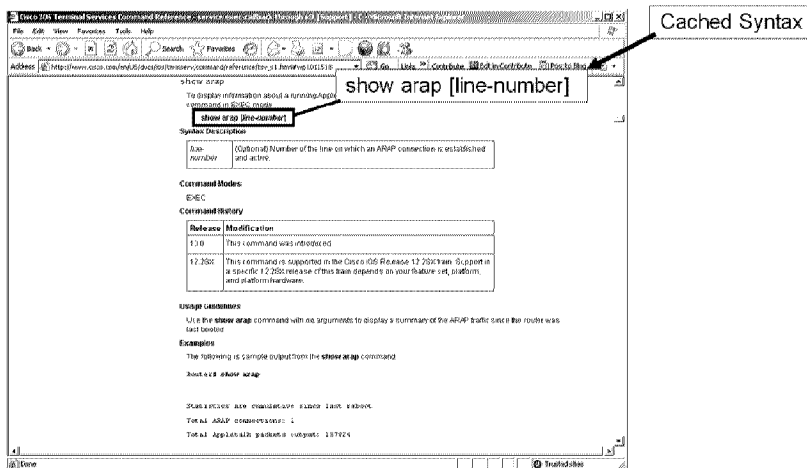
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## Components of the solution

- Cisco IOS command documentation



When the CICV tool finds the documentation for a command, it caches the text for the syntax from the HTML code – this all happens behind the scenes, the web page is shown here to help you visualize the process

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## Components of the solution

### ■ PCA data

Partial extract from PCA data file – c7200p-adventerprisek9-mz-exec.dump  
from 12.4(24)T



```
<tokens>
<id>show_arap</id>
<index>3</index>
<type>KW</type>
<token>arap</token>
<macro>KEYWORD</macro>
</tokens>
<action>
<name>show_arap_eol</name>
<chainFileDir>/vob/ios/sys/arap</chainFileDir>
<chainFile>ara_chain.c</chainFile>
<configFile>exec_show_arap.h</configFile>
<func>show_arap</func>
<line>45</line>
<macro>EOLNS</macro>
<cExpr>{ara_chain.c-exec_show_arap.h:46(cs-b-#38,#62;val1=0xFFFFFFFF)}</cExpr>
</action>
<cmdText>show arap</cmdText>
</CommandContext>
<CommandContext>
<tokens>
<id>exec_show</id>
<index>2</index>
<type>KW</type>
<token>show</token>
<macro>KEYWORD</macro>
</tokens>
```

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# Components of the solution

- CICV error report – cached CLI syntax compared with PCA data

A		B	
1	CICV Error Status	Command	Syntax Analysis
53	Command has errors	show arap	show arap lty <number>
54			show arap aux <number>
55			show arap console <number>
56			show arap vly <number>
57			
58	Command is not documented	show archive config rollback commands	show archive config rollback commands <text-s
59			show archive config rollback commands <text-s
60			

show arap command is found to have errors – it has undocumented keywords

## Agenda

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## Results from SDCC Phase 1

- Focused on **show** commands in 12.4(22)T
- Identified 438 undocumented **show** commands
- Identified 168 **show** commands for which the documentation is missing syntax
- Opened 549 doc bugs

Some of the errors were found in the documentation of older content that is no longer maintained

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## Results from SDCC Phase 1

- Total number of **show** commands with errors – 606
- If the number of undocumented **show** commands is added to the number of documented **show** commands, there should have been 2797 commands documented in the database
- 21% of the **show** commands are either undocumented, or documented with errors

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## Agenda

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## Other CICV Features

- Command Doc Quality Analysis – MCLs

The screenshot displays the Cisco IOS Command Validation Tool interface. At the top, a header bar contains the title "Cisco IOS Command Validation Tool". Below this, a navigation menu includes "Command Doc Quality Analysis - MCLs" (which is highlighted), "Command Doc Quality Analysis - CRs", "Compare Releases", "Syntax Walker", and "MCL Reverse Analysis". The main content area features a "Read PCA Files" button on the left and a "Master Command List URLs" input field on the right. Below the input field is a "ReportLog" section with a large text area and a "Download Final Report" link. At the bottom of the interface are "Submit" and "Clear" buttons, and a "Version 0006" label in the bottom right corner.

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## Other CICV Features

- Command Doc Quality Analysis – MCLs

Compares the commands listed in the MCLs with a list of commands in the database to identify commands that have documentation, but the documentation is not appearing in the on-line documentation

In SDCC phase 1 there were 28 **show** commands in the database that did not appear in the 12.4T MCL



## Other CICV Features

- Compare Releases

The screenshot displays the 'Cisco IOS Command Validation Tool' interface. At the top, there is a navigation bar with the following tabs: 'Command Doc Quality Analysis - MCLs', 'Command Doc Quality Analysis - CRs', 'Compare Releases' (which is highlighted), 'Syntax Walker', and 'MCL Reverse Analysis'. Below the navigation bar, the main content area is titled 'Master Command List URLs'. It features a 'Read PCA Files' button on the left and a large text input field on the right. Below the input field is a 'Report Log' section with a large rectangular area for displaying results. At the bottom of the interface, there are 'Submit' and 'Clear' buttons, a link for 'Download Excel Report', and a version number 'Version 0006' in the bottom right corner.

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## Other CICV Features

- Compare Releases

Compares the command CLI syntax in the PCA data from any two Cisco IOS releases and reports the differences

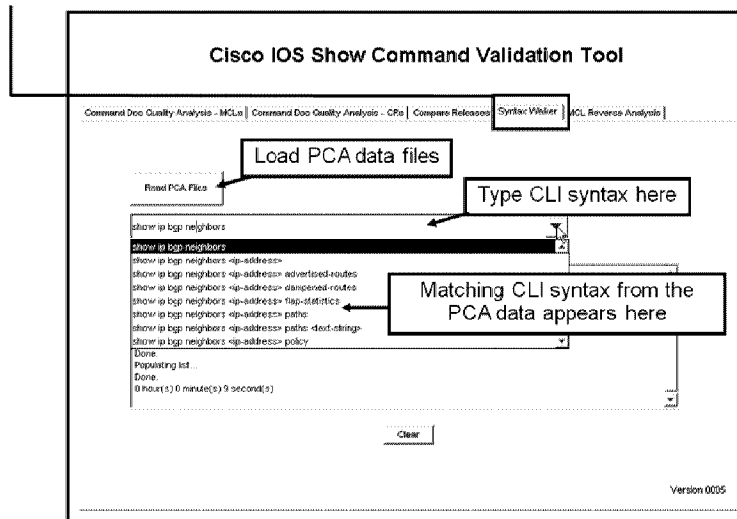
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## Other CICV Features

### ▪ Syntax Walker



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## Other CICV Features

- MCL Reverse Analysis

The screenshot displays the Cisco IOS Command Validation Tool interface. At the top, a navigation bar includes links for "Command Doc Quality Analysis - MCLs", "Command Doc Quality Analysis - CRs", "Compare Releases", "Syntax Walker", and "MCL Reverse Analysis". The "MCL Reverse Analysis" link is highlighted. Below the navigation bar, the main content area is titled "Master Command List URLs". It features a "Read PCA Files" button and a text input field. Below this is a "Report Log" section with a large text area and a "Download Excel Report" link. At the bottom of the form are "Submit" and "Clear" buttons. The version number "Version 0006" is displayed in the bottom right corner of the tool interface.

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## Other CICV Features

- MCL Reverse Analysis

Used to compare the commands listed in a MCL for a release with the commands in a PCA report for the release to identify commands that are listed in the MCL when the command is not supported in the release

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## Agenda

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## What's Next

- Add support for Cisco IOS releases other than 12.4T to the PCA tool

Right now there is no funding for PCA improvements

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## What's Next

- Automatic CLI verification for Configuration Documentation

Extracts CLI syntax from tasks and configuration examples in configuration guides and features modules

Sends the CLI syntax to an appropriate networking device to verify the CLI syntax is supported and reports errors

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